

First-aid care for chemical burns

Translation of the following italian publication :

“Trattamento in emergenza delle ustioni chimiche”

M Cavallini- L D'Alessandro

UO di Chirurgia Plastica e Ricostruttiva

Ospedale Galeazzi, Milano, Italy

Emergency Oggi 2002, january, 12-14

Burns due to chemical agents cause very complex injuries. Tissue coming in direct contact with the toxic agent undergoes chemical destruction.

Household and occupational accidents account for most of the cases. The probability of exposure to toxic agents is about the same in these two environments.

As described below, chemical substances can be divided into acid and basic agents with characteristic chemical compositions leading to various mechanisms of local and general toxicity.

Chemical agents can cause five categories of burns depending on the mechanism of the injury:

- 1) corrosion or irritation: caustic soda
- 2) dehydration: hydrochloric acid
- 3) oxidation: sodium hypochloride
- 4) denaturation: hydrofluoric acid
- 5) vesication (blistering): solvents

Organic damage, which occurs during the last phase of tissue destruction subsequent to protein denaturation, leads to tissue necrosis. It is strongly correlated with:

- 1) the composition of the chemical product
- 2) the route of penetration
- 3) the duration of exposure
- 4) the surface area exposed
- 5) the presence of clothing.

The goal of first aid-care is to limit the severity of the chemical burn as rapidly as possible. Three elements must be kept in mind:

a) **extension:** the rule of nine is a simple method to evaluate body surface area:

- head and neck	9%
- anterior portion of the trunk	18%
- posterior portion of the trunk	18%
- right upper limb	9%
- left upper limb	9%
- right lower limb	9%
- left lower limb	9%
- perineum	1%

b) **depth:** three degrees are described

- first degree burns

are limited to the epidermis. The principal signs are redness, pain, and swelling.

- second degree burns

involve the epidermis and the superficial layers of the dermis. The principal signs are blisters and pain.

- third degree burns

injure the entire dermis, and in some cases the hypodermis. The principal sign is the absence of pain, because the nerve endings are destroyed.

c) **Localization**

Burns involving the

- head or neck
- hands
- natural orifices

are particularly serious.

Chemical burns involving the ocular area are frequent and can lead to severe injury to the eye, with a real risk of blindness if appropriate care is not given rapidly, i.e. within minutes following the accident.

Adequate first aid requires two levels of treatment:

On the site of the accident

A. The first, and most important, thing to do is to neutralize and/or dilute the toxic chemical substance.

Flush the injured area with running water for at least six minutes. Strong flow must be used if the chemical substance produces an exothermic reaction when exposed to water (for example acids) because the heat produced could aggravate the injury.

B. A neutralizing substance can be used as an alternative or second step. The problem is to choose an adapted substance since it is not always easy to identify the toxic agent. DIPHOTERINE, a recently marketed solution, is a very interesting neutral washing agent that can provide effective neutralization for both acids and bases. The same solution can be used for the skin and for the eyes. (See photo of the eye wash material).

C. While flushing, evaluate the extent of the injury using the rule of nine.

D. If possible, obtain a sample of the toxic chemical agent.

Emergency care (for medical personnel or emergency squad)

E. The risk of chemical burns may not be limited to local toxicity. In some cases, the systemic effect may lead to a general disease state.

Shock is a particularly serious reaction which may occur within the first seventy-two hours following the accident. Shock results from deficient tissue perfusion. Clinical manifestations of hypovolemic shock include:

- weak rapid pulse,
- dyspnea and polypnea
- cold pale skin
- tachycardia
- oligouria.

Kidney function must be closely monitored due to the risk of renal shock and acute renal failure.

It is also important to monitor respiratory function which, in the particular situation of lung shock, can lead to massive pulmonary edema and acute cor pulmonale (acute heart failure).

Key points

During the pre-hospital period

- a. install a venous line and infuse electrolyte fluid
- b. cover the patient with a sterile sheet for asepsia
- c. install a urine drain to evaluate water balance.

In the emergency room

- a. evaluate respiratory function and if necessary initiate respiratory assistance
- b. continue the fluid infusion, preferably with an isotonic solution
- c. give anti-tetanos prophylaxis.